

CONTENTS

11. SUMMARY OF ENVIRONMENTAL OUTCOMES.....	11-1
11.1 Introduction.....	11-1
11.2 Environmentally Friendly Options Considered and Incorporated in the Recommended Design Scheme	11-1
11.3 Environmental Designs Recommended.....	11-1
11.4 Environmentally Sensitive Areas Protected.....	11-3
11.5 Estimated Population Protected from Various Environmental Impacts	11-4
11.6 Key Environmental Problems Avoided and Compensation Areas Included	11-4
11.7 Environmental Benefits of Environmental Protection Measures Recommended	11-5

Tables

Table 11.1 - Summary of Key Environmental Problems Avoided and Sensitive Areas Protected

Table 11.2 - Key Recommended Mitigation Measures and Associated Environmental Benefits

11. SUMMARY OF ENVIRONMENTAL OUTCOMES

11.1 Introduction

11.1.1 This Section summarises the key environmental outcomes arising from the EIA Study in accordance with clause 3.6.1 of the EIA Study Brief (ESB-334/2020). The EIA (covering air quality, noise, water quality, waste management, ecology, cultural heritage and landscape & visual) has concluded that no unacceptable environmental impacts are envisaged due to the construction and operation of the Project with the implementation of the recommended mitigation measures. No long-term unacceptable impact on the environment is anticipated.

11.1.2 **Chapter 2** of this EIA have presented the alternative options considered relating to the design, construction and operation of the Project.

11.2 Environmentally Friendly Options Considered and Incorporated in the Recommended Design Scheme

11.2.1 Based on the evaluation and comparison of design options in **Chapter 2 - Table 2.2** and **Table 2.3**, Conforming Scheme will introduce more environmental impacts to air quality, noise impact and C&D material at Nam Bin Wai due to the construction of the proposed diversion box culvert. Design Option 2 will introduce more environmental impacts to air quality and noise impact to major residential area at Mui Wo while Design Option 3 will introduce more impact close to Graded Historic Sites/ Buildings/ Structures which is not preferred. Hence, the above-mentioned design options are not recommended to pursue.

11.2.2 For Design Option 1, the alignment of diversion box culvert is shorter, location of stormwater pumping station is located away from major residential area and disturbance to Luk Tei Tong River can be avoided while the construction period will be the shortest in general. Hence, the duration and magnitude of environmental impacts for Design Option 1 could be minimized compared with other design options. Despite the proposed stormwater pumping station and alignment of stormwater drain at Ma Po Tsuen may introduce potential landscape and visual impact and C&D waste respectively, the environmental impacts and waste introduced can be mitigated by implementation of proper mitigation measures. In view of the above, Design Option 1 is considered more preferable and recommended to pursue.

11.3 Environmental Designs Recommended

11.3.1 To minimise the water quality impact, river flow will be diverted to the far side of the works area. Cofferdam and /or other means of temporary flow diversion will be undertaken before any excavation / major works within the existing watercourses to ensure the flow is not affected and to provide a dry working environment. In addition, excavation of river sediment will be scheduled to carry out in dry seasons (typically from November to March) as far as practicable. The same principal will be adopted for construction of tidal gate and mechanical penstock to minimise the water quality impact during construction.

- 11.3.2 All excavated river sediment will be reused on-site as backfill material. River sediment and/or boulders excavated during river reprofiling works will be reused at Tai Tei Tong River as natural bedding substrate and/or as backfilling material at other works area. Such construction method could avoid the disposal of sediment. Also, the semi-natural habitat at upstream of Tai Tei Tong River could be maintained.
- 11.3.3 Enhancement measures include provision of fish ladders at mid-stream of Tai Tei Tong River and up-stream of Tai Tei Tong River to relieve the level difference which hinders fish movement along the river. Upon completion, fish movement along the river can be enhanced. The fish ladder will be designed using natural bedding material with small ponds and waterfalls to mimic the natural stream course and provide habitats for aquatic life.
- 11.3.4 Enhancement measures such as river revitalisation works will also be introduced along Luk Tei Tong Bypass Channel which could improve and enhance the appearance of the rivers and surroundings. Blue-green infrastructure concepts will be adopted in this Project, such as planting and landscaping work along riverbanks to promote greening, enhance biodiversity and beautify the surrounding environment. Leisure facilities will also be provided appropriately along Luk Tei Tong Bypass Channel to improve the amenity value.
- 11.3.5 Precast flood wall/ pre-filled gabion wall could minimize the environmental impact to air quality, construction noise and water quality. However, since the works area are located close to public access which lifting and unloading of precast flood wall/ gabion wall could pose significant safety concern and nuisance to pedestrian nearby. As such, on-site construction method for flood wall/ gabion wall will still be preferred to shorten the construction period, hence minimise the potential environmental impacts to the nearby sensitive receivers.
- 11.3.6 Majority of the drainage works are located along existing pedestrian and vehicles access roads and will be implemented by open-cut excavation method as the trenchless excavation required wider pit area which is not preferred area close vicinity to pedestrian and road users. Despite open-cut excavation method could pose environmental impacts to air quality, construction noise and water quality, open-cut excavation method is considered to be faster which the duration of environmental impact can be generally reduced. To further minimize the environmental impacts to air quality and construction noise, as well as nuisance to public, drainage works will be carried out on a section-by-section basis.
- 11.3.7 For drainage works at river crossing, trenchless excavation method will be adopted. In general, trenchless excavation method only require excavation at launching and receiving pit locations which excavation at riverbed can be avoided and environmental impact to water quality can be minimized. In addition, inert C&D material generated from trenchless excavation method can be reduced compared with open-cut excavation method.
- 11.3.8 A cross bridge will be constructed across Pak Ngan Heung River to the works area of stormwater pumping station as an access during construction and maintenance access

during operation. The cross bridge will be constructed by prefabricated steel structure off-site which environmental impact to air quality and construction noise can be minimized. Bridge column will not be required to constructed at the Pak Ngan Heung River which and hence water quality impact can be avoided.

- 11.3.9 The same construction principal for excavation within river channel as mentioned in **Section 11.3.1** will be adopted for proposed tidal gate and mechanical penstock to minimize the water quality impact during construction. Since the main components of proposed tidal gate and mechanical penstocks will be made of steel and / or other non-concrete material with is project specific design to suit the site condition, precast structures or MiC unit for supporting structure will not be feasible and on-site construction for supporting structure will be preferred to allow more flexibility for on-site alteration and installation of E&M equipment.
- 11.3.10 Temporary structures and construction works will be planned with care to minimise disturbance to vegetation including riparian vegetation along the river as well as existing built structures. The footprint of the Project will be kept to a practical minimum and form, textures and colours selected to be as compatible with the existing surroundings as possible.
- 11.3.11 The proposed stormwater pumping station will integrate the concept of sustainability and green building design including green roof and vertical greening such as plating of climbers to enhance the greenery of proposed structure. Measures to safeguard environmental quality and reduce the carbon footprint include retaining natural vegetation, phasing of construction to minimise noise and dust emissions, stormwater reuse by means of rain harvesting for irrigation purpose will be adopted.
- 11.3.12 In addition, the applicability of usage of renewable energy (i.e. Solar Panel) for leisure facilities, street lighting, flood control system and electrical and mechanical (E&M) system within the stormwater pumping station will be adopted as far as practicable in order to reduce the energy consumption and carbon emission during the operation phase of the Project.

11.4 Environmentally Sensitive Areas Protected

- 11.4.1 With the consideration of various alternative design and construction methods, the Project has avoided or minimised the following environmental problems:
- Minimisation of the number of environmental sensitive receivers to be affected;
 - Avoidance of encroachment into recognized sites of conservation importance;
 - Minimisation of disturbance of ecological habitats;
 - Avoidance of loss of trees and retaining trees as many as practicable; and
 - Minimisation of disturbance of cultural heritage.

11.5 Estimated Population Protected from Various Environmental Impacts

11.5.1 With the adoption of the environmentally friendly design in the preferred option, all the existing environmental sensitive receivers at Luk Tei Tong, Ma Po Tsuen, Tai Tei Tong, Ling Tsui Tau and Chung Hau will be protected with the implementation of mitigation measures and good site practice. This recommended design option has already determined based on the comparison of the environmental impacts, benefits and dis-benefits of the various options and alternatives and has been selected on the basis that it minimises environmental impacts and presents overall environmental benefits over the other options and is considered the optimum and recommended scheme from an environmental perspective.

11.6 Key Environmental Problems Avoided and Compensation Areas Included

11.6.1 All recognized sites of conservation importance have been identified and no works will encroach into any recognized sites of conservation importance or important habitats. As such, no compensation area will be required.

11.6.2 **Sections 11.2** and **11.3** have summarized the key approaches adopted in the preferred option to avoid, minimize and mitigate environmental impacts. Some of these approaches have contributed to avoid number of environmental problems and to protect several environmental sensitive areas. **Table 11.1** below presents the key environmental problems that have been avoided and any sensitive areas protected by these approaches.

Table 11.1 - Summary of Key Environmental Problems Avoided and Sensitive Areas Protected

Design Approach	Environmental Problems Avoided and Sensitive Areas Protected
Avoid construction of flood wall / reconstruction of gabion wall at Luk Tei Tong River (West)	<ul style="list-style-type: none"> Disturbance to existing natural environment at Luk Tei Tong River (West) can be avoided.
Avoid construction of mechanical penstock at upstream of Tai Tei Tong River	<ul style="list-style-type: none"> Adverse impacts on water quality, noise, ecological and landscape & visual impact during construction and operation can be avoided.
Avoid construction of Stormwater Pumping Station at major residential area in Mui Wo	<ul style="list-style-type: none"> Adverse impacts on air quality, noise and landscape & visual impacts to the sensitive receivers at the major residential area in Mui Wo can be minimised.
Avoid construction works near Graded Historic Sites / Buildings / Structures	<ul style="list-style-type: none"> Cultural heritage impact to the Graded Historic Sites / Buildings / Structures during the construction and operation of the Project can be avoided.
Avoid excavation works for the drainage improvements carrying out at wet season	<ul style="list-style-type: none"> Adverse impact on water quality during construction of the Project can be avoided.
Implementation of environmental monitoring and auditing system during construction phase	<ul style="list-style-type: none"> Ensure that all the recommended mitigation measures are properly implemented and so adverse impacts on air quality, noise, waste, ecology and water quality to the sensitive receivers can be minimised.

11.7 Environmental Benefits of Environmental Protection Measures Recommended

11.7.1 Mitigation measures have been recommended to further reduce the environmental impacts during the construction and operational phases of the Project. Key recommended mitigation measures and associated environmental benefits are summarized in **Table 11.2** below.

Table 11.2 - Key Recommended Mitigation Measures and Associated Environmental Benefits

EIA Aspects	Key Recommended Mitigation Measures	Environmental Benefits
Air Quality	<p><u>Construction Phase</u></p> <ul style="list-style-type: none"> • Implement relevant dust control measures stipulated in the <i>Air Pollution Control (Construction Dust) Regulation</i>, and good site practices. • Regular maintenance of construction equipment deployed on-site should be conducted to prevent black smoke emission. • Connect construction plant and equipment to mains electricity supply and avoid use of diesel generators and diesel-powered equipment as far as practicable to minimize the emission impact from these machineries on nearby residents. • Excavated river sediment will be reuse on-site, stockpiling of river sediment will be avoided as far as possible. If temporary stockpiling of river sediment is necessary, the excavated sediment will be covered by tarpaulin to avoid potential dust / odour emission. • Maintain site cleanliness and tidiness of construction site and control on NRMMS. <p><u>Operation Phase</u></p> <ul style="list-style-type: none"> • If temporary stockpiling of desilted material is necessary, the stockpiles will be covered by tarpaulin to avoid potential odour emission and avoided to be placed near the ASRs with close distance (i.e. <10m). Desilted material shall also be properly covered when placed on trucks or barges. 	<ul style="list-style-type: none"> • Protect air sensitive receivers by reducing construction dust emission and odour nuisance, and gaseous emission from construction plant and equipment.
Noise	<p><u>Construction Phase</u></p> <ul style="list-style-type: none"> • Adopt good site practice (e.g., use of well-maintained plant, utilize of silencers or mufflers on construction equipment, etc.) to mitigate the noise impact. • Use of quiet PME with SWL lower than the value specified in the GW-TM to mitigate the construction noise impact. 	<ul style="list-style-type: none"> • Protect noise sensitive receivers by reducing construction and operational noise impacts.

EIA Aspects	Key Recommended Mitigation Measures	Environmental Benefits
	<ul style="list-style-type: none"> • Use of quieter construction method (e.g., share use of dump truck and/or concrete lorry mixer at the works area close proximate to NSRs). • Adoption of temporary noise barrier or noise enclosure with surface density of at least 14kg/m², without opening gaps to screen the noise source from sensitive receiver. • Scheduling of PME / construction activities to avoid work during sensitive time (e.g., school examination period) and reduce the concurrent operation of PMEs. <p><u>Operation Phase</u></p> <ul style="list-style-type: none"> • The ventilation fan exhaust should be orientated to face away from the NSRs as far as practical, acoustic louvers are proposed to be adopted at all ventilation fans. • Quieter equipment should be selected during procurement. • Noise level specifications for all equipment and silencers should be included when ordering equipment. 	
Water Quality	<p><u>Construction Phase</u></p> <ul style="list-style-type: none"> • Construction works should be conducted by segments / smaller areas to allow better control and limited potential water quality impact. • Following standard measures and good site practice from ProPECC PN1/94 to avoid/minimise the potential impacts. • All runoff and wastewater generated from the works areas should be collected and treated to meet standards as listed in the TM-DSS under WPCO. • Adopt the control measures outlined under ETWB Technical Circular (Works) No. 5/2005 Protection of Natural Streams/Rivers from Adverse Impacts Arising from Construction Works. • Cofferdam would be first installed to create dry work area for part of the cross section without significantly impeding the flow to contain any loss of sediment into the water column for sediment removal at River Silver. • Proper control, handling and disposal of chemicals according to Code of Practice on the Packaging, Handling and Storage of Chemical Wastes as well as Waste Disposal 	<ul style="list-style-type: none"> • Protect the downstream water sensitive receivers.

EIA Aspects	Key Recommended Mitigation Measures	Environmental Benefits
	<p>(Chemical Waste) (General) Regulation (Cap. 354C) to reduce the reduce risk of accidental spillage.</p> <p><u>Operation Phase</u></p> <ul style="list-style-type: none"> • Containment structures such as sandbags barrier should be used for the desilting works area to facilitate a dry and confined working area within the drainage channel. • Light machinery and hand-held machine should be considered when undertake maintenance desilting works and debris clearance. • The waste material /dredged materials should be temporary stored away from the channel and cover with tarpaulin sheet. • Avoid and minimize the use of concrete or the like. • Real time monitoring of water level would be conducted to allow adaptive management to prevent and minimize potential impact on hydrology and water quality from the proposed drainage improvement works. 	
Waste Management	<p><u>Construction Phase</u></p> <ul style="list-style-type: none"> • Avoidance, minimization, recycling, treatment and safe disposal of waste. • Good waste management and control practices to avoid generation of excessive amount of waste. • C&D materials should be excavated, transported and disposed of in a manner to minimize adverse environmental impacts. • Proper storage, handling and disposal of chemical waste. • Proper storage, recycling and disposal of general refuse. • Reuse the excavated sediment as backfilling material. <p><u>Operation Phase</u></p> <ul style="list-style-type: none"> • The screenings, silt materials and debris collected during operation and maintenance should be properly packed and transported to the designated landfill for disposal as soon as possible. • All chemical waste should be properly stored, labelled and removed by licensed waste collectors in accordance with Waste Disposal (Chemical Waste) (General) Regulation. 	<ul style="list-style-type: none"> • Minimize waste generation. • Ensure proper handling and disposal of C&D material. • Ensure proper handling of general refuse & chemical waste.

EIA Aspects	Key Recommended Mitigation Measures	Environmental Benefits
Ecology	<p><u>Construction Phase</u></p> <ul style="list-style-type: none"> • Project site has been selected based on environmental and other consideration which located away from identified Night Roosting Site, Fung Shui Woods, Country Parks, and other ecologically sensitive receivers. • Unavoidable impacts to natural terrestrial habitats have been minimised by taking appropriate and practicable measures such as restriction of river reprofiling works at Tai Tei Tong River to dry season as far as practicable and confining works in specific area during daytime hours. • As a precautionary measure, construction works at the works area of stormwater drain near Mui Wo Municipal Services Building during night-time from 17:00 to 07:00 should be avoided to minimize potential disturbance to the Ardeids. • Strong artificial lighting should not be used in the area at night to avoid disturbance to the roosting Ardeids. Lighting required for safety purpose should keep minimal and pointed inward. Clear signs should be erected on site to alert all site staff and workers about the requirement. • Restriction of river reprofiling works at Tai Tei Tong River under the Project to dry season as far as practicable. <p><u>Operation Phase</u></p> <ul style="list-style-type: none"> • For maintenance desilting of the re-profiled river channels, temporary barrier walls shall be used to provide a dry zone for desilting work. • The implementation of de-silting and other activities that could disturb aquatic fauna should be scheduled section by section and the works will be confined in a small works zone which is isolated from the rest of the channel by temporary barrier walls to ensure some areas of relatively undisturbed habitat remain available for resident aquatic fauna at all times. 	<ul style="list-style-type: none"> • Avoid impact to recognized sites of conservation importance. • Minimize ecological impact during construction stage. • Mitigate ecological impact during construction stage. • Ecological enhancement opportunity.
Cultural Heritage	<p><u>Construction Phase</u></p> <ul style="list-style-type: none"> • Inform AMO immediately when any antiquities or supposed antiquities under the A&M Ordinance (Cap. 53) are discovered during the course of works. • Design proposal, method of works and choice of machinery should be targeted to 	<ul style="list-style-type: none"> • Protect close proximity graded historic buildings, new items for Grading Assessment and built heritage items during construction.

EIA Aspects	Key Recommended Mitigation Measures	Environmental Benefits
	<p>minimize adverse impacts to graded historic sites/buildings/structures.</p> <ul style="list-style-type: none"> • Vibration and building movement induced from the proposed works should be strictly monitored to ensure no disturbance and physical damages made to them during works. Monitoring proposal, record, condition surveys should be submitted to AMO for approval and record. • Conduct cartographic and photographic records to record the agricultural weirs prior to commencement of modification works. <p><u>Operation Phase</u></p> <ul style="list-style-type: none"> • No mitigation measures would be required 	
Landscape and Visual	<p><u>Construction Phase</u></p> <ul style="list-style-type: none"> • Temporary structures and construction works should be planned with care to minimise disturbance to vegetation including riparian vegetation along the river as well as existing built structures. • Tree preservation, tree transplantation and compensatory tree planting to minimise the potential the disturbance to the trees and compensate the loss if necessary. • Tall screen/buffer trees shall be planted to screen the proposed channelised water course. • Erection of decorative hoarding to reduce undesirable view from sensitive receivers. • River sediment and / or boulders excavated during river reprofiling works are to be reused at Tai Tei Tong River as natural bedding substrate. • Control the lighting with reference to guidelines in “Charter on External Lighting” and “Guidelines on Industry Best Practices for External Lightning Installations”. • River Revitalization work in terms of planting and provision of leisure facilities will be conduct along Luk Tei Tong Bypass Channel to enhance ecological and amenity value of the surrounding. • Green roof and corresponding landscape work such as planting of climbers, shrubs and bamboo would be carried out for proposed stormwater pumping station in order to enhance the greenery of proposed structure. <p><u>Operation Phase</u></p>	<ul style="list-style-type: none"> • Enhance the landscape quality and visual appearance of the project.

EIA Aspects	Key Recommended Mitigation Measures	Environmental Benefits
	<ul style="list-style-type: none"> • Colours for the structures e.g. fences should be chosen to complement the surrounding area. Lighter colours such as shades of light grey, off-white and light brown may be utilised where technically feasible to reduce the visibility of the structures. • Tree transplantation and compensatory tree planting to minimise the potential the disturbance to the trees and compensate the loss if necessary. • Tall screen/buffer trees shall be planted to screen the proposed channelised water course. • River sediment and / or boulders excavated during river reprofiling works are to be reused at Tai Tei Tong River as natural bedding substrate. • River sediment and / or boulders excavated during river reprofiling works are to be reused at Tai Tei Tong River as natural bedding substrate. • Control the lighting with reference to guidelines in “Charter on External Lighting” and “Guidelines on Industry Best Practices for External Lightning Installations”. 	